

## FyreWrap® LiB Papers

### Introduction

FyreWrap® LiB (Lithium-ion Battery) Papers from Unifrax are a family of high-temperature, lightweight insulating materials designed to prevent thermal runaway propagation in lithium-ion battery applications.

Building on our thermal management expertise and manufacturing excellence, combined with extensive experience in aerospace, automotive and fire protection application, Unifrax offers customized solutions for lithium-ion thermal runaway propagation prevention.

The base of our technology starts with our fiber manufacturing techniques. Unifrax offers a variety of fiber types such as low bio-persistence fibers, refractory ceramic fibers, micro-fine glass fibers and polycrystalline fibers. Dependent upon the finished product's desired characteristics, these fibers are converted into different forms with varying options for additional enhancements.

### Properties

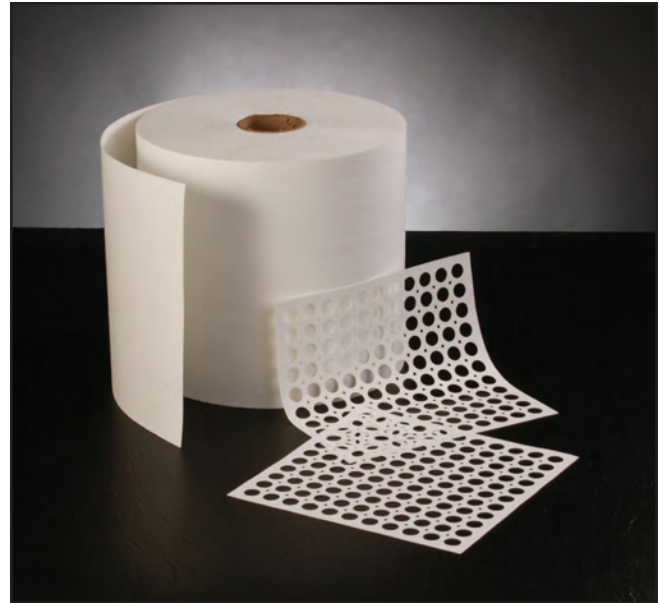
- Fire resistant, flame barrier
- Electrically insulating
- Low thermal conductivity/thermal insulating
- Suitable for temperatures up to 1600°C
- Uniform lightweight flexible sheets
- Easy to wrap, shape or cut
- Excellent chemical stability
- Exceptionally resistant to thermal shock
- Non-woven compressible fiber matrix

### Capabilities

- Thermal runaway propagation prevention
- Short circuit prevention and electrical protection
- Cascading fire prevention
- Thermal isolation and containment

### Applications

- Cells (external to cell)
- Battery modules
- Battery packs
- Packaging for transportation



### Markets

- E-Mobility
- Grid Storage
- Energy Storage Systems (ESS)
- Military
- Aerospace
- Consumer Electronics
- Medical
- Transportation packaging

Customer requirements are unique and Unifrax offers solutions that cater to each application's performance criteria, cost structure, and product handling needs. The information presented refers to our core products and their typical characteristics. Unifrax offers application support for many specifications and/or enhancements, such as:

- Adhesive and foil backings
- Encapsulation and lamination
- Hybrid fiber systems
- Rigidization of components
- Resin moldable additives

Please contact the LiB team to discuss additional enhancement requirements at 716-768-6472.



www.marianinc.com  
1-800-773-0062



## FyreWrap LiB Papers Typical Product Properties

Paper Grade		Physical Properties					
	Color	Temperature Grade		Melting Point		Density	
		°F	°C	°F	°C	lb/ft <sup>3</sup>	kg/m <sup>3</sup>
<b>FX70</b>	White	2300	1260	3260	1793	10	160
<b>IN70</b>	White	2300	1260	2390	1310	10	160
<b>SA95</b>	White	3000	1600	—	—	10	160
	Fiber Index <sup>1</sup>	LOI <sup>2</sup>	Dielectric Strength	Tensile Strength	Compression (% PSI Deformation)		
	% Wt	Including Binder, % Wt	V/mil, ASTM D149	PSI	20%	30%	40%
<b>FX70</b>	70	7	220-250	94	4.1	18.1	43.5
<b>IN70</b>	>70	<12	180-240	51	1.6	11.5	30.1
<b>SA95</b>	>95	7	—	—	—	—	—
Chemistry							
	Al <sub>2</sub> O <sub>3</sub>	SiO <sub>2</sub>	Na <sub>2</sub> O	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	Trace Elements
<b>FX70</b>	47-52	48-53	<0.5	<0.5	—	—	—
<b>IN70</b>	—	62-67	—	—	28-33	1-6	<1
<b>SA95</b>	90	8	—	—	—	—	2
Available Thickness							
	0.8	1	1.6	2	3	3.2	6
<b>FX70</b>	X	X	X	X	X	X	X
<b>IN70</b>		X		X	X		X
<b>SA95</b>		X		X	X		
Other Properties							
	Dielectric Strength (ASTM D149)	Dielectric Constant (DC)	Arc Resistivity (ASTM D495)	Surface Resistivity (ASTM D257) Ohms/Square	Other material sizes available upon request		
<b>FX70</b>	~240	1.26	<40 Seconds	1.01E+11	Notes: (1) Represents the percent by weight of fiber in the material (2) Represents loss in mass at 1000°C		
<b>IN70</b>	~210	1.26	<12 Seconds	1.03E+11			

Unifrax offers many UL listed FyreWrap® product forms and FyreWrap fire protection materials for passive fire protection applications. Unifrax has received the following UL certifications and/or met the following standards listed pertaining to classes of products most similar to those listed above: UL 723, ASTM E84, ASTM E136, ASTM E1529 (UL 1709).

Please contact Unifrax for your specific design requirements.



# FyreWrap®

The following is a registered trademark of Unifrax: FyreWrap.

The test data shown are average results of tests conducted under standard procedures and are subject to variation. Results should not be used for specification purposes.

Product Information Sheets are periodically updated by Unifrax. Before relying on any data or other information in this Product Information Sheet, you should confirm that it is still current and has not been superseded. A Product Information Sheet that has been superseded may contain incorrect, obsolete and/or irrelevant data and other information.